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# FOUNDRY TRADE JOURNAL

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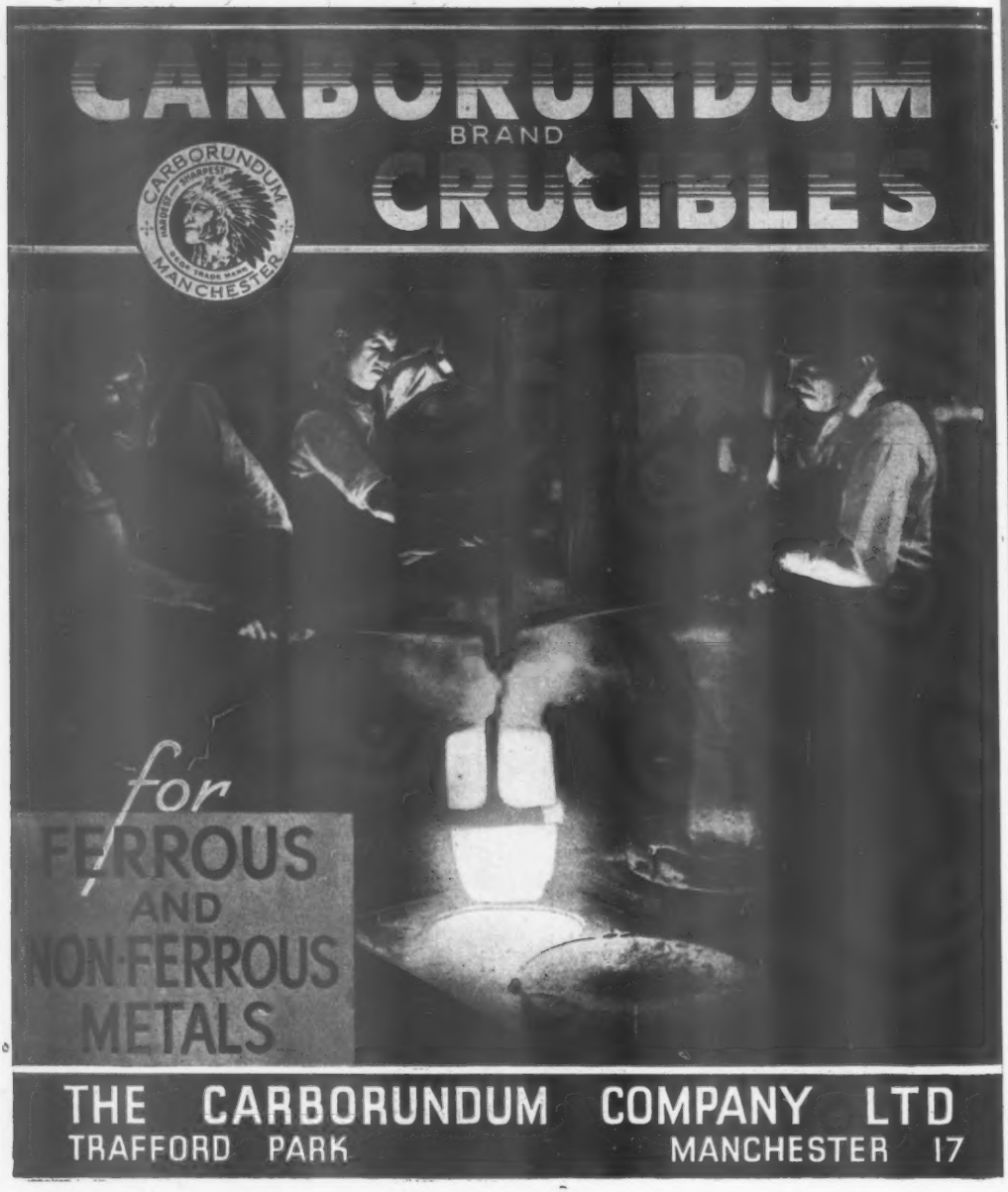
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FOUNDRY TRADE JOURNAL
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Vol. 71 Thursday, September 9, 1943 No. 1412

## True Quality

The quality of castings is normally measured by a number of chemical, physical and mechanical tests, but there is a further test—that of industrial life. War conditions have brought this feature to the foreground of discussion from several quite different angles. The shopkeeper finds that he cannot sell low-grade wearing apparel no matter how low the price if coupons have to be surrendered by the purchaser. Thus the retail trade has become quality-minded. At the other end of industry, the incidence of taxation has placed into high relief the question of depreciation of plant and machinery. From the traditional 5 or 10 per cent. per annum, the works accountants are now anxious to arrive at something nearer the truth. Many executives thought they were erring on the conservative side in the estimates, but the quality of all machines and tools will not stand up to prolonged day and night work such as war conditions demand. Thus the conservative 10 to 20 years of life envisaged by depreciation allowances is not being realised. Good buying in the pre-war years is now showing up to advantage and firms which sacrificed quality for price are paying the penalty. In instance, a certain industrial job required for satisfactory life a battery of enamelled containers. In past years these were supplied by a firm which gave the containers three coats of enamel fired at really high temperatures. The price was of the order of £11, but a price-cutting buyer changed his supplier for one quoting £10. There was a useful life reduction of over 50 per cent., which quickly revealed the real quality-price ratio. This correlation of depreciation with quality is likely to be of increasing import so long as taxation remains at high levels. In this connection, castings, in general, give a good account of themselves as components of machinery and plant. This factor should be brought before those bodies which buy on behalf of the householder—often on the hire-purchase system. The large public utility organisations handling gas and electric cookers and the like have a greater interest in intrinsic value than in quick sales based on flash selling points, because they retain both financial and technical interest in these apparatus for several years. Thus, depreciation is likely to have an increasing influence on their purchases in the immediate post-war era. If foundries find it impossible to furnish the quality they know they could attain under normal conditions, they must, in justice to themselves and the industry of which they are a part, label their merchandise "war finish." This will enable the buyer to depreciate his purchases at a higher figure than normal. There must be no falling into the trap of imagining that the British populace wants something new and novel, which can be reflected in the not too distant future, because the exigencies of war have too strongly impressed upon everybody the benefits to be had from buying the best and not something "attractively priced."

## New Aluminium Process

After a year's study, an advisory committee of the National Academy of Sciences in the United States has recommended that use be made of a new aluminium process whereby a substantial quality of clay may be introduced with the bauxite feed. The committee has also found that treatment of the tailings from the Bayer process, containing iron, titanium and silica compounds, by a recently developed sintering process will result in the recovery of substantial amounts of alumina. This process will permit the production of alumina from high-silica bauxite, as well as from current accumulations of red mud. Of several processes to produce alumina directly from clay, the committee looks with most favour on the modified sintering method known as the Pedersen process, and recommends the Construction of a test plant for its fuller investigation.

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## BOOK REVIEWS

**Commodity Control. First Supplement.** By J. B. Freeman. London: Butterworth & Company (Publishers), Limited, Bell Yard, Temple Bar, W.C.2. (Price 3s., postage 3d.)

The principal work to which this supplement has now appeared was reviewed in our issue of April 15 last; that work contained every wartime Statute and Order dealing with commodity control up to February last. Since that date, a number of further important Orders has been issued, and these are now included in the First Supplement. If the main work is constantly in use, the present Supplement is indispensable for keeping abreast of the latest legislation. This Supplement, which fits into the back cover of the main work, contains a revised table of Statutory Orders and 42 pages of amendments to the main work. It is proposed to publish further supplements at frequent intervals to keep the work thoroughly up to date.

**Applied Mechanics.** By Dr. A. Morley. London: Longmans, Green & Company, Limited, 43, Albert Drive, S.W.19. (Price 7s. 6d.)

This text-book covers the ground of the third or final year of a three-years' part-time course of instruction leading to an ordinary grade National Certificate in mechanical engineering, and is also suitable for students taking the applied mechanics examination for associate membership of the major professional engineering institutions. It forms another, although quite separate, volume of the author's series of text-books of engineering science. A wide field is systematically covered; separate chapters are devoted to statics, friction and machines, kinematics, the principles of dynamics, circular motion, oscillatory motion, hydrostatics, hydraulics, stress and strain, structures, and bending and twisting. Formerly professor of mechanical engineering in University College, Nottingham, and a staff inspector of technical schools, the author has applied his wide experience in producing a useful and interesting text-book, which departs entirely from the arid method of presentation so common in the older text-books. The author's explanatory and free style is a very welcome innovation and will commend itself to students. Only in one direction is the reviewer disappointed; the author does not seem to favour the inclusion of copious exercises, the working of which we have found to offer the only royal road to mastering a subject with a mathematical basis. To make up for this dearth, the author nevertheless does provide the practical rather than the academic type of example. We should like to see more text-books on the lines of Dr. Morley's treatment of applied mechanics.

E. R. F.

**The South American Handbook, 1943.** Edited by Howell Davies. London: Trade & Travel Publications, Limited, 14, Leadenhall Street, E.C.3. (Price 3s. 6d.)

One of the most immediate problems facing British industry and trade after the war is that of reviving our export trade all over the world. A *sine qua non* in this direction is a first-hand knowledge of the countries, their government, conditions and trade customs, to which we must strive to sell. As regards South America, this vast range of information is available in the current issue of the South American Handbook for 1943, the successor of the Anglo-South American Handbook and now in its twentieth annual edition. It covers all Latin America, including South and Central America, Mexico and Cuba, in its 700 pages. Besides giving an authoritative geographical, industrial and agricultural background for each of the countries concerned, there are many sections on seasons for visits, travel and communications, money values, trade and hygiene, passport and immigration regulations, exceptionally useful to prospective visitors and agents. The Handbook is a reliable *vade-mecum* to the business man, traveller, investor, student and prospective settler.

## NEW PUBLICATIONS

**Foundry Sand Practice.** By Clyde A. Sanders. Published by the American Colloid Company, 363, West Superior Street, Chicago, Ill., U.S.A.

This publication is an excellent example of technical service to industry, though, of course, it is in America where its maximum utility will be felt. In its 48 pages there is a common-sense disclosure of how to use the two sorts of bentonite to the best advantage in the various sections of the foundry industry. Formulæ are detailed not only for grey iron, steel, malleable iron and magnesium sand foundry practice, but also for core making. An idea of the extensive data given can be cited in reference to steel practice. Here formulæ are given for green sand to include bench work, medium (four types) and heavy, skin dried (five types, including a facing sand for manganese steel); dry sand-facing, and general (three types). The pamphlet is apparently being distributed gratis to the American foundry industry.

**Brass Foundry Flux.**—Fifteen claims for the efficiency of BritMultA Red flux for use with the heavy non-ferrous alloys are set out in a four-page illustrated leaflet received from Multiple Acting Flux, Limited, 8, Ashgate Road, Broomhill, Sheffield, 10.

## NOTES FROM THE BRANCHES

*London.*—The autumn session will open at 6.15 at the National Liberal Club, London, S.W.1, on Thursday, September 23, when Mr. H. W. Lockwood will deliver his Presidential Address. This will be followed a a Paper on High Silicon Cast Iron by Dr. J. E. Hurst, past-president of the Institute. On September 29, at 6.30 p.m., in the Lecture Theatre of the Research Department of High Duty Alloys, Limited, Slough, Mr. G. E. France, managing director, Augusts, Limited, Halifax, will deliver a lecture on Foundry Mechanisation. Mr. T. Makemson, secretary of the Institute and Joint Director of Iron Castings, has promised to preside.

# THE CONTRIBUTION OF THE STEEL FOUNDER TO MARINE ENGINEERING

*Sixth Edwards Williams Lecture to the Institute of British Foundrymen*

By STANLEY FABES DOREY, D.Sc., Wh. Ex., Chief Engineering Surveyor to Lloyd's Register of Shipping

(*Continued from p. 6*)

### Ship's Machinery

In regard to ship machinery, mention has already been made of gear wheels. In addition, besides a number of important auxiliaries, there is the main propelling machinery which may consist of steam turbines, oil engines, steam reciprocating engines, or some special combination such as reciprocating-turbo, turbo-electric or diesel-electric. In each installation cast steel in some form or other may play a prominent part.

Turbine cylinders in which high pressure steam is used are invariably made of cast steel. Some of these are very intricate castings calling for a high standard of moulding skill. For naval vessels, in which weight must be kept to a minimum, the required scantlings and consequent distribution of metal in the casting present special problems to the steelfounder. Fig. 7 represents a "close-up" view looking on the joint face of the bottom half of a turbine cylinder. The narrow cored passages in way of the gland, and bearing spaces, can be clearly seen. The turbine nozzle box, which directs the inflowing steam to the moving blades, is another intricate casting calling for a high degree of skill in core making. A nozzle box is shown in Fig. 8. An arc-shaped nozzle plate holding the stationary nozzles will be secured to the face of the nozzle box. Turbine nozzle castings, sometimes called diaphragms, are also shown in Fig. 9. In these cases the nozzle passages may be very small, and their varying dimensions must be accurate. These diaphragms are sometimes made by "casting in" the steel plates which form the nozzle passages.

Wherever severe conditions of high temperature, corrosion, abrasion or shock are encountered—and such conditions are quite common in marine engineering—then the engineer looks to the steelfounder for his material. It is not necessary to give a comprehensive catalogue of machinery parts for which cast steel has been found most suitable, but the more important items include turbine cylinders, valves and fittings, gear cases, gear wheels, Diesel engine crankshafts, connecting rods, main bearing housings and keeps, valves and valve levers, cylinder covers and liners, pistons, steam engine piston and slide valves, bedplates and engine entablatures. Figs. 10 and 11 illustrate examples of cast-steel Diesel engine crankwebs, the former weighing 6¼ tons as cast, and the latter, which also embodies a balance weight, having a cast weight of 10 tons 14 cwts. Incidentally, it is of interest to note that this weight is reduced to 4 tons 6 cwts. after machining—a reduction in weight of 60 per cent.

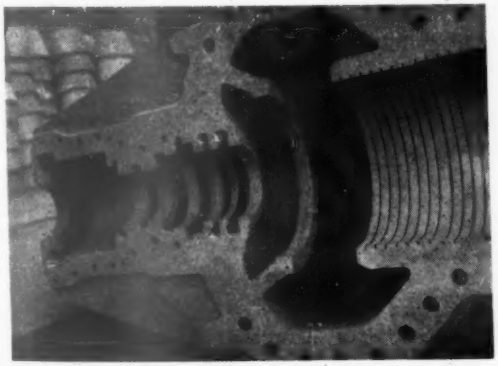

FIG. 7.—BOTTOM HALF OF TURBINE CYLINDER.

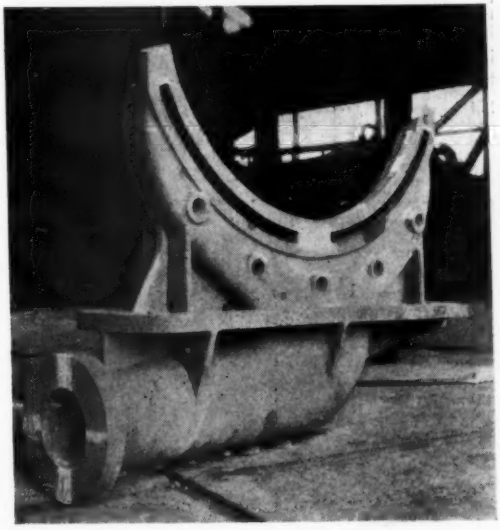

FIG. 8.—NOZZLE BOX.

## Sixth Edwards Williams Lecture

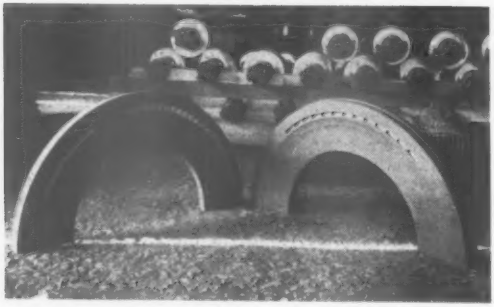

FIG. 9.—TURBINE NOZZLE CASTINGS.

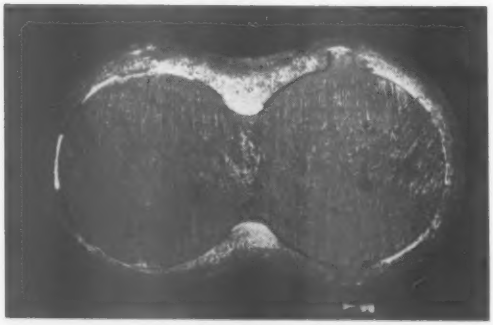

FIG. 10.—DIESEL ENGINE CRANKWEBS.

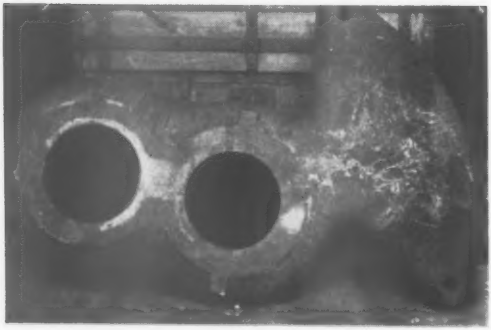

FIG. 11.—DIESEL ENGINE CRANKWEBS.

In electrical generating machinery, baseplates, stator frames, and armature rotors are sometimes made of cast steel, and, when necessary, castings can be produced in steel having special magnetic properties. Armature rotors may form an intricate casting, as will be observed in Fig. 12.

From time to time proposals to use cast-steel crankshafts and propeller shafting for merchant ships have been accepted by Lloyd's Register of Shipping. These proposals have usually been the result of some difficulty or delay in the delivery of steel forgings, which are, of course, more commonly used for these parts. In every instance, however, the castings have been required to comply with a standard of strength equal to forged steel, and except in a few cases where casting defects have been present, they have given satisfactory service.

### Chilling Bars Prohibited by Lloyds

Some years ago, I took part in an inquiry into the failure of some Diesel engine crankshaft webs made in cast steel. A peculiarity of this trouble was that fine star cracks developed in the periphery of the webs after they had been shrunk on to the pins and body pieces; further, the cracks were found only after a lapse of some time—they did not occur immediately. The inquiry opened up a complete investigation of the method of casting the webs. These had been cast vertically, and the feeding heads had been removed by flame cutting. As the position of the cracks coincided with the position of the feeding heads, it was considered that during flame cutting, molten metal had filled the cracks and obliterated them, so that, in fact, the cracks had been there, just below the surface, all the time. It was also found that some manufacturers introduced chilling bars into their castings with the object of hastening the process of freezing, and so rendering the provision of ample feeding heads less imperative. These internal chilling bars in no way prevented the formation of defects, but simply transferred them to a point midway between the chilling bar and the surface of the casting. Further, any trace of rust on the bars would result in the evolution of gases, with the consequent formation of blow-holes. It was, therefore, decided to prohibit the use of chilling bars for steel castings intended for ships classed by Lloyd's Register of Shipping.

In the case of a manufacturer who cast his crankwebs in a vertical position, subsequent experiment proved that best results were obtained when the webs were cast flat and slightly inclined, with three shrinkage heads, two of which were situated at positions which would afterwards be removed completely by boring out, thus any unsound metal would be removed. Figs. 13, 14 and 15 illustrate the method used, Fig. 13 showing the crankweb as cast, Fig. 14 after removal of the shrink heads, and Fig. 15 after boring. Fig. 16 shows a section through such a crank web and reveals a good clean casting. The well-rounded edges should be noted. These facilitate casting and obviate sand flaws.

It is in investigation of troubles of this nature that it is advantageous for the engineer and steelfounder

to get together; the former approaches the problem from the point of view of how the casting is to be used, and the latter from the point of view of how the casting is to be made.

### Co-operative Research in the Future

Whilst progress in the art of steelfounding has, in many cases, been the forerunner of major developments in engineering, the converse is equally true, and the engineer has contributed in no less degree to the improvements made in steelfoundry equipment. Again, it is primarily the demands made by the engineer for material of special qualities which has stimulated foundry development and research. Examples include the chromium-nickel alloys which have the special property of resisting intergranular corrosion, nickel-chrome-molybdenum steel which, after suitable heat-treatment, has a high resistance to shock and is specially suitable for heavy duties, and chromium-carbon steel for castings requiring greater strength, toughness and hardness, as required for gear blanks.

In marine work rust-resisting steels can be usefully employed for underwater valves and fittings, hydraulic machinery pump components and many other items, as, for example, cabin and bathroom fittings. For these purposes the steelfounder can produce castings in several types of chromium and chromium-nickel stainless steels.

Also available among the special alloy steel castings is a low-carbon steel of high magnetic permeability used in electrical machinery. Special foundry difficulties arise in this case from the necessity of reducing carbon, silicon and manganese to a minimum.

The modern trend towards higher steam temperatures provides the field for carbon molybdenum steel castings, which have a high limiting creep stress at elevated temperatures.

All these special quality steels, and others which may be called for in the future, have their attendant

FIG. 13.—METHOD OF CASTING CRANKWEBS. CRANKWEBS AS CAST.

FIG. 12.—ARMATURE ROTOR.

FIG. 14.—CRANKWEBS AFTER REMOVAL OF SHRINK HEADS.

## Sixth Edwards Williams Lecture

problems of fluidity, heterogeneity, refractoriness of moulding sand, etc., which the steelfounder has to solve. The problems have often been attacked in the past by trial and error. To-day there is less reason to use these methods, because steelfoundry research has in recent years been properly organised on a co-operative basis under the direction of the Steel Castings Research Committee which is a joint committee of the Iron and Steel Institute and the British Iron and Steel Federation. This committee has addressed itself to a number of cardinal problems associated with the production of steel castings, and several very valuable reports have been issued. Investigations have been made into fluidity and freezing characteristics of alloy systems, the effect of casting temperatures and pouring rates, and the properties of moulding sand. The committee has also given attention to questions relating to inspection of steel castings, including X-ray and gamma-ray examination. Much research work, however, remains to be done, especially in regard to the practical aspect of foundry methods and materials, and their influence on the formation of defects in the casting. It is by no means uncommon for castings to be rejected after considerable machining has been carried out, and there is a feeling amongst engineers that the general run off steel castings is not entirely satisfactory, and that marked improvements could be made.

FIG. 15.—CRANKWEBS AFTER BORING.

### The Steel Founder and the Welder

A further field for research is in the production of what are called "thin-walled castings," for which there are many uses in engineering. One of the special advantages of mild-steel welded construction is the rational disposition of material, enabling parts to be proportioned in accordance with the contemplated stress distribution. The "massiveness" usually associated with a casting, and which is often required only for foundry purposes, may be quite unimportant in land machinery, but may be undesirable in a marine installation where weight may be more a liability than an asset.

It is in this direction that the steelfoundry will meet the competition of the welding industry. This competition, in its limited sphere, is entirely healthy. Taking a broader view, the steelfounder and the welder are both essential to engineering progress. It may well be that parts formerly made in cast steel can now be more economically produced as mild-steel "weldings," but there remain many parts for which welding is quite unsuitable, both from the economic and technical standpoints. Castings of special and intricate design as well as repetitive castings of standard design will always be required both in plain carbon and alloy steels, and whilst new methods of manufacture must inevitably arise, they should be accepted in the right perspective, for steelfounding with all its long acquired experience and knowledge, will never lapse into the realm of lost arts. There is in consequence a great need for vigorous prosecution of research, and wider training and education in the industry.

### Training and Education

In this connection, I am of opinion that students taking foundry courses at the universities and technical colleges should have at least two years' practical experience of foundry work. Only thus can they assimilate that essential knowledge of the trade in all its aspects which is to be derived from personal contact with the tools and the men who handle them.

(*Concluded on page* 33.)

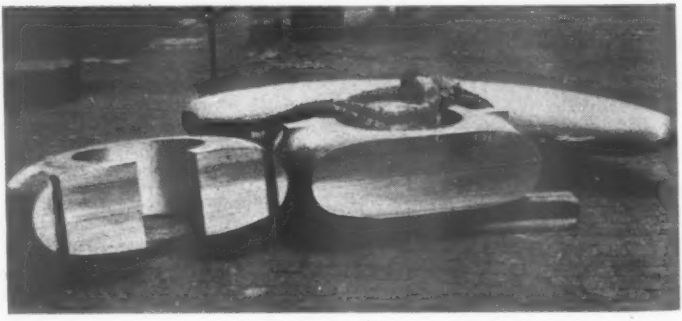

FIG. 16.—SECTION THROUGH CRANKWEB.

# SOME ASPECTS OF THE PRODUCTION OF MALLEABLE IRON CASTINGS

By J. ROXBURGH, A.M.I.Mech.E. (Member)

*Paper read at the Fortieth Annual Conference of the Institute of British Foundrymen*

(*Continued from page* 14.)

### Spherical-Shaped Feeders

It had been the custom, in the author's foundries, to use various shapes of feeders according as to whether they were top, side or joint feeders, but, as referred to previously, the author, where possible, introduced a spherical-shaped feeder or a modification of this type for the reasons already explained.

It was found possible to substitute joint blind feeders by spherical-shaped ones (Fig. 1), thus reducing the amount of metal required. Varying sized spheres, ranging from 1½ in. dia. up to 5 in. dia. and stepping up in ¼-in. size in diameter, were made available, and the most suitable size discovered by sample castings which were broken up. Sometimes it was found necessary, still retaining the bottom half of the sphere, to increase the height of the top half by introducing a cylinder 1 in. or 2 in. long between them. All these types of feeder are mouldable, and the shape of the feeder enabled the metal to retain its heat longer and rendered feeding more effective. With some castings, the bottom half of the feeder could be dispensed with and a feeder used shaped as a cylinder with a hemisphere superimposed. Such feeders are useful when joined to a vertical wall of metal.

Feeders on top of a casting, in the past, have been invariably cut through the cope of the mould and very often supplemented by the contents of a bush placed above the mould, in order to increase the depth of the feeders. The top surface of such feeders is exposed to the atmosphere and cools more quickly than desired and the feeders very often have to be made larger for this reason. The author introduced a method which he claims to be quite novel, not only in the saving of feed metal used, but also in retaining its heat. The top feeder used is again spherical in shape (Fig. 2, A, B and C). The bottom hemisphere is moulded and the top hemisphere formed in a core, which has a hole in the top through which metal can be added. This core not only 'stops-off' the length of the feeder and forms a spherical shape, but helps to retain the heat of the feed metal.

The feeder pattern made use of is loose, and consists of a hemisphere at the bottom with a block print above, the length of which carries it through the cope. The feeder pattern is withdrawn from the mould, and the stop off core, to form the top half of the sphere, is inserted in the print. All cores are made from a standard corebox and are therefore the same length. The core may come level with the top of the box; it may project beyond, or the core may even be placed on the top of the box, when, of course, it must be filled up by extra metal, as it is above the level of the mould. If the top of the core comes below the top of the box, sand can be rammed above it.

This type of feeder is used on the top as well as on the side of castings (Fig. 3), not on the joint; the length of the feeder in the latter case is reduced by a stop-off core to form a spherical shape, the same procedure as with top feeders. These spherical-shaped feeders are very effective and a great deal of metal is withdrawn from them by the casting, sometimes only a shell of metal remaining, if the metal is particularly hot.

### Suitability of Spherical-Shaped Feeders

There may be divergent opinions as to the reason for such spherical-shaped feeders, the top half of which is formed in a core, being so effective, apart from the obvious reasons that the metal is protected from the atmosphere and also that a sphere dissipates its heat less rapidly. Although not quite analogous to the introduction of a small core in a feeder to prevent the formation of a crust and thereby permitting atmospheric pressure to be exerted on liquid metal, as developed by Taylor and Rominiski, yet maybe the atmosphere plays its part, due to the increased permeability of the 'stop-off core.'

However, a malleable feeder does not crust over so quickly as a steel one, but the author has made certain observations in regard to this matter during his experience. On different occasions, for instance, joint feeders from the same casting have been examined from different casts. In one case the top surface of the feeder remained liquid whilst feeding continued, and the sink hole was visible on the top of the feeder. In another case, a crust a half-inch thick had formed on the top of the feeder and no sink hole was visible. These two feeders were subsequently weighed, and there was no appreciable difference in their weight. The crust of that feeder, with no sink hole visible, was eventually chipped through, and the feeder was found to have sunk appreciably. In both feeders referred to, therefore, the metal had been withdrawn by the casting to the same extent, despite the fact that one was frozen over at the top and the other had remained liquid. These observations are not casual, as the author has noticed this behaviour quite frequently.

### Application of Chills

The methods in use to obtain a sound casting would not be complete without reference to the application of chills to castings. Generally speaking, the use of chills should be avoided, wherever it is possible to obtain soundness in a casting by feeding or by some

## Malleable Iron Castings

other means, such as change of design. On the other hand, however, chills, properly applied, can give successful results. For instance, a thick part of a casting due to its isolated position may not permit of feeding, but a chill suitably placed may render it solid. Again the combination of a chill and feeder is sometimes practised with good effect. A chill placed at the bottom of a section of metal, fed by a top feeder, may help to reduce the amount of feeding metal required, due to the action of the chill in accelerating the progressive solidification from the bottom upwards. Chills, too, are used in cores to solidify some thick section or junction of thick and thin sections occurring in a casting.

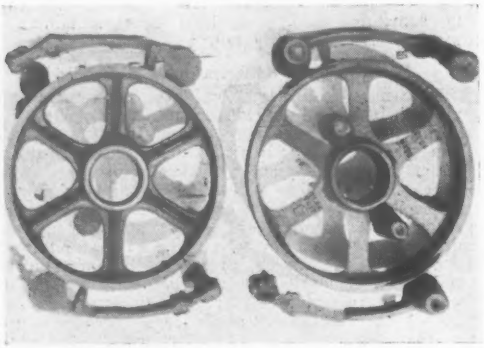

FIG. 11A.—TWO VIEWS OF TANK WHEEL CASTING, WITH FEEDERS AND RUNNERS ATTACHED.

With thick sections it is often imperative to use chills in order to ensure such sections being 'white,' or in other words to be free from mottle and primary graphite. It is well known that the occurrence of primary graphite in a casting is most undesirable as, after annealing, such a casting is weaker than ordinary cast iron.

It is as well to mention, although quite familiar to all foundrymen, that there is always a danger that the metal will 'kick' off a chill, causing blowing, the gas generated being liable to be trapped. Reeves states that ". . . for good results, chills must be absolutely dry, free of rust, and above all must be properly placed in mould or core. . . ." Various coatings for chills have been the subject of experiment, but the author advocates the application of a thin coating of a proprietary oil compound, which usually consists of dextrin and linseed oil.

### Economy in Metal

The yield of good castings from the metal melted is always an important consideration in any foundry, and the author has been able, by careful investigation and by resort to the methods outlined, to effect economies in the amount of metal required to produce a certain tonnage of castings, which affects melting costs, cost of metal lost in melting and other ancillary charges in addition.

In the location of feeders on the casting, due consideration should be given initially to ease of grinding, and as little as possible should be left on the casting at a point easily accessible. There is quite an art, too, in moulding the 'break off' where the feeder joins the casting. If not properly moulded, when the feeder is subsequently knocked off, a piece may be broken out of the casting. The feeders and mouths, connecting to the casting, should not freeze until the casting has completely solidified. Where possible, feeders should not be attached to the casting at points which are to be utilised later for location by the machinist, particularly for mass production machining. At times, location points are altered by mutual agreement, to accommodate the founder's

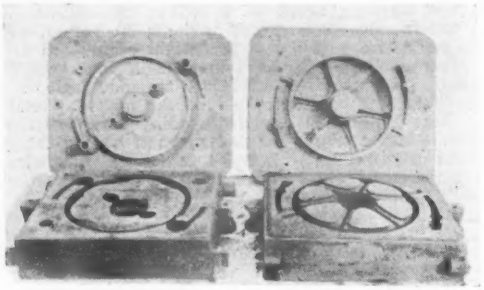

FIG. 11B.—TWIN PATTERN PLATES, WITH COPE AND DRAG FOR TANK WHEEL CASTING.

arrangements for successful feeding of a casting.

It is obvious that castings for repetition machining must be extremely accurate in regard to dimensions and freedom from distortion. In order to achieve this accuracy, within foundry limits, all tackle supplied, patterns, coreboxes, moulding boxes, etc., should be of the highest quality. It is incumbent on the manufacturer, too, to institute a high standard of inspection at as many stages as may be deemed necessary during manufacture and to safeguard, finally, that no casting be released to the customer which does not reach a definite standard.

### Floor and Bench Castings

Owing to the small number of castings required or to the non-suitability of a job for machine moulding, such a job is made loose on the floor or bench. Under such circumstances thought must be given to gating and feeding, and the arrangements should not be left entirely to the moulder himself. Loose or fixed runners are provided and feeder pads screwed on the patterns and suitable feeder patterns made

available. In this way sound castings are produced and feeders and gates kept within reasonable limits as regards size. Occasionally, large quantities of large and intricate castings are ordered and quicker methods of production must be instituted.

Fig. 4 illustrates a casting which was made on the floor with a special lay-out. Although the casting was intricate, the pattern was printed up such that a flat joint was possible. The two half-patterns were mounted on boards and moulding boxes supplied, made specially for the job. The top and bottom moulds were rammed by separate moulders, and one moulder was engaged fully on closing operations. Fig. 4A shows the pattern tackle, Fig. 4B the cores, eleven in number; Fig. 4C, the top and bottom parts of the mould; Fig. 4D, coring up in progress; and Figs. 4E and 4F depict two different views of the casting, together with runners and feeders. This

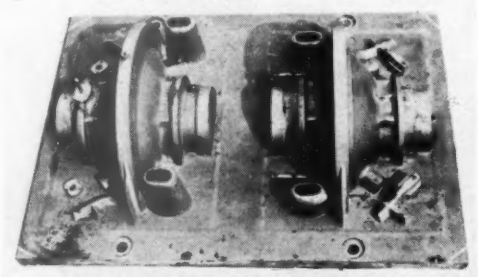

FIG. 12A.—PATTERNS FOR COPE AND DRAG MOUNTED ON ONE PLATE, FOR TANK HUB CASTING.

casting is a bottom bevel gear drive casing, weighs 62 lbs., and is used on a tank. The method adopted for its manufacture considerably simplified and increased production.

### Machine Moulding

For castings, where regular orders are obtained, and which lend themselves to production on moulding machines, hand and power operated machines are utilised, and some examples will be described. Figs. 5A and 5B illustrate two hand-operated four-pin lift machines, the twin pattern plates being shown together with the top and bottom part moulds in flasks. Fig. 5C is a view of the two castings made in these moulds and the method of running and feeding adopted. It will be noticed that the metal enters the mould on the joint, being sprayed into each casting, whilst the feeders are located at a higher level on the castings, in order to feed a heavy section, these feeders being placed on top of cores in order to make this possible. With a view to keeping the feeders hot, metal is run into the feeders through a hole in the cores.

Sometimes, it is necessary to manufacture on these hand machines castings which have irregular joints for moulding. An example of such a casting is shown in Fig. 6A, which depicts the twin cast plates. Fig. 6B gives a view of the top and bottom part moulds, whilst Fig. 6C shows the bottom part cored up and a jig, located by the pinholes in the flask, serving to centralise two round cores. The castings produced are illustrated in Fig. 6D, the runner and feeders being attached.

### Jolt-Squeeze Machines

Another type of machine used in the author's foundry is the jolt-squeeze machine, which accommodates standard sizes of steel moulding boxes, 15 in.

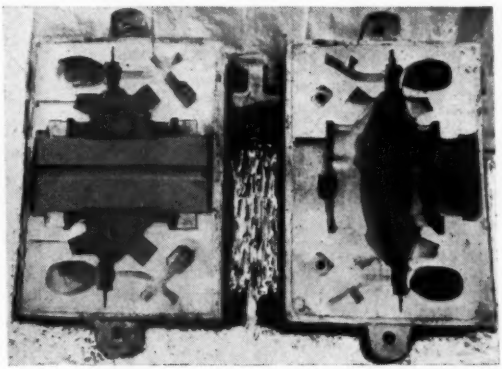

FIG. 12B.—COPE AND DRAG, WITH CORING UP IN PROGRESS, FOR TANK HUB CASTING.

by 12 in., 17 in. by 13 in., and 17 in. square. The boxes are 6 in. deep, but at times frames are used to increase the depth. Fig. 7A shows a layout for 3-in. trench mortar bombs, four patterns being mounted on twin plates for a 17 in. by 13 in. steel box. The spherical feeder should be noted, together with top feeders. These castings were made vertically, primarily because they have to undergo a pressure test and also so that the core may be placed central and at the correct height, in order to give the required volume inside the casting, a vital matter. In Fig. 7B the cores have been placed in position in the bottom part of the mould, and a jig, located from the pinholes of the box, is used to centralise the cores, and a further gauge, shown, to govern the depth of the cores. The bottom print on the pattern is made nearly as large as the casting diameter, so that the metal itself holds the core down. Fig. 7C shows the core-box, provision being made for blowing two cores simultaneously; the core driers are also illustrated.

Another interesting job undertaken in the author's foundry is a 21-in. torpedo nose piece, the moulds for which are made on a similar jolt-squeeze machine,

## Malleable Iron Castings

but in this case 17 in. square steel boxes are utilised. The twin pattern plates and the castings are shown in Fig. 8A. The arrangements for running and feeding are illustrated, the top feeders being knocked off actually when hot. In Fig. 8B are shown the top and bottom parts of the mould, and better results on this particular casting were obtained after synthetic sand was introduced as better venting and running were obtained. These castings are liable to crack, and, as a consequence, every casting is placed in an oven as soon as it is set and whilst it is still red hot, in order to avoid this possibility. Such castings undergo machining all over the outer surface and are subjected finally to a pressure test.

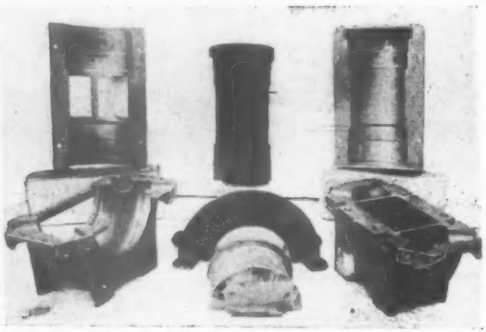

FIG. 12C.—COREBOXES, CORES AND CORE JIG, FOR TANK HUB CASTING.

A further example of a high production machine is the jolt-squeeze stripper or four-pin lift machine. This is illustrated in Figs. 9A and 9B, where the twin plates are mounted on the machines, Fig. 9B showing a mould pushed off and Fig. 9A giving a view of the two parts of the mould. The casting, shown in Fig. 9C, has the runners and feeders attached, and is a plate used on a tank. Excellent castings have been produced by this method, and synthetic sand is again used for moulding.

### Use of Jolt Roll-Over Machines

With larger castings, requiring regular high production, jolt roll-over machines have been found to be very successful indeed. Fig. 10A gives a view of a typical layout used in conjunction with such machines, showing the roller conveyors from the machines, and the moulds, by a transfer bogie, are then conveyed on to further roller conveyors for casting. The bottom part of the mould is shown cored up, whilst the top part is being turned over previous to closing. It should be noted that the core has been lightened out and rammed up with black sand, to take care of contraction. The moulds already closed and clamped can be seen in the background preparatory to casting. In Fig. 10B the outside and the inside profiles of the casting are depicted. This casting weighs over 1 cwt. and is the axle housing for a 3-ton lorry. The running and feeding arrangements are shown, and many ties are required on such a casting to counteract 'the occurrence of "pulls" or "tears."'

In order to facilitate coring up, the cores supplied to the moulder should be accurate and should require no attention by the moulder whatsoever, except to saw-cut a tie which cannot be placed in the corebox. Each half-core made is placed in a cast-iron jig, a partial facsimile of the mould, with the joint and bearings accurately machined and the core rubbed off to accurate size. In Fig. 10C will be noted the half-corebox, two half-cores after jigging and the core jig itself.

Another type of casting laid out for quantity production is illustrated in Fig. 11A. The moulds, shown in Fig. 11B, are made on a jolt roll-over machine coupled up to a roller conveyor system. This casting is a wheel weighing 52 lbs. and is used on a tank. In Fig. 11A the method of running and feeding is clearly depicted. It will be noted that two side feeders are attached to the centre boss. At one time one top feeder on the boss was used, but a great amount of grinding was necessary to templet, too, and also such feeders were knocked off 'hot.' The two side feeders proved to be quite successful and there is very little grinding to be carried out after they have been knocked off. This casting takes 14 secs. to pour, and it will be noted that there is a 'grid' placed at the bottom of the downgate and a further one placed vertically in the runner gate. In addition half of the gate is moulded in the cope, whilst the 'V git' is in the bottom part of the mould. These precautions are taken to ensure the cleanliness of the casting.

A further illustration of castings produced on a jolt roll-over machine is provided in Figs. 12A, 12B,

FIG. 12D.—TWO VIEWS OF TANK HUB CASTING, WITH FEEDERS AND RUNNERS ATTACHED.

12c, 12d and 12e. In this case, see Fig. 12a, two half-patterns are mounted on each machine, and two moulding boxes used so that each machine can produce one complete mould, the two machines used simultaneously, thus producing two complete moulds. This casting is a wheel hub for a tank and weighs 98 lbs. In Fig. 12b will be seen the two parts of the mould, with coring up in progress in the drag. It will be noted that in addition to the bore core, there is a chamber core, with four outlets, two of which are used to carry off the gases. The cores are shown in Fig. 12c. The half-corebox for the bore cores is shown at the top of the picture and a

Fig. 12e.—Tank Hub Casting, with "Top Spherical Feeder." Compare with "Top Feeder" shown in Fig. 12d.

jig is used to ensure the accuracy of the two halves. In the lower half of the picture the corebox for the chamber core is illustrated. In the centre of the photograph, a dried chamber core is shown, with the core drier extracted and placed in front of it. Two views of the castings are shown in Fig. 12d with the runners and feeders attached. Synthetic sand has again been used for the moulds. Fig. 12e shows a view of the same casting and illustrates clearly the difference between a 'ball feeder' and the usual top feeder.

### Conclusion

The author has purposely confined his attention to certain aspects of the production of malleable castings, but nevertheless has been able to deal in some detail with the use of synthetic sand, gating and feeding of castings, and with some methods of moulding carried out in his foundry. Such matters as construction of patterns and coreboxes, coremaking and other important considerations, must be left perhaps for some future occasion. The author hopes that he has been successful in directing the attention of the reader to the important aspects which he has endeavoured to discuss, and to the development work which has taken place in recent years in the foundry practice associated with the manufacture of malleable castings. The engineer has certainly displayed a keen interest in the products of the malleable industry, and it should always be the founder's aim, not only to sustain it, but, by virtue of the maintenance of quality of casting and by the introduction of further improvements, to enhance that interest.

In conclusion, the author wishes to acknowledge the permission given by the directors of Ley's Malleable Castings Company, Limited, to publish this Paper.

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[3] "Utilising Atmospheric Pressure and the Steel Casting," by H. F. Taylor and E. A. Rominski. Trans. A.F.A., Vol. 50, No. 1, 1942, p. 215; see also "Foundry Trade Journal," October 15, 22 and 29, 1942.
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## THE CONTRIBUTION OF THE STEEL FOUNDER TO MARINE ENGINEERING

(*Concluded from page* 28.)

I am happy to conclude this lecture with the comment that, whilst for some years Foundry Courses have been included in the curriculum of technical colleges in the U.S.A., France, Belgium, Germany and Italy, in Sheffield University there is available what is probably the most comprehensive scheme for foundry education in the world. A degree course in foundry science is provided in the Faculty of Metallurgy, and throughout the sessions numerous trade lectures are given to foundry operatives. The industry has been fortunate in the work of Prof. J. H. Andrew, who in addition to the organisation of educational facilities, has contributed so largely to general research in the University laboratories.

It is a matter for congratulation that this Institute has played a major part in establishing these educational facilities both in Sheffield and, originally, in Birmingham.

It may give some satisfaction to the members of this Institute to receive an engineer's unqualified acknowledgment of the great and far-reaching contributions which the steelfounder has made, and continues to make, to all branches of engineering.

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**Production of steel ingots** and castings in Canada in the first five months of the current year amounted to 1,259,652 tons, a small decline from the 1,305,075 tons produced in the like 1942 period. Pig-iron output in the first five months amounted to 719,900 tons, as compared with 806,039 tons in the corresponding 1942 period.

## SINTERING OF MOULDING SANDS

A recent issue of "Die Giesserei" contains two Papers dealing with the application of the high-temperature electron microscope, recently designed by M. v. Ardenne, to a study of the behaviour of moulding sands on exposure to casting temperatures. In the first Paper, which forms Report No. 5 of the Moulding and Core Sands Committee of the Verein deutscher Giessereifachleute, M. v. ARDENNE and K. ENDELL deal with researches on the changes taking place in the bonding materials or fillers of these sands during sintering when metal at a high temperature is cast into a sand mould. They suggest that the behaviour of these bonding materials is an essential factor in sintering, since they act as a flux. The stronger the sintering action, *i.e.*, the greater the bonding action exercised by the fluxes on the quartz particles constituting the bulk of the sand, the lower will be the amount of scale and its adhesion to the casting, with a consequent reduction in fettling costs. A study of the behaviour of these bonding materials at the casting temperature is thus of value in foundry practice, suggest the authors.

In the authors' work, images of 4,000 magnifications were obtained with the electron microscope of a variety of clays and German bentonites, first at room temperature and then at various temperatures between 1,200 and 1,600 deg. C. Forty-two of these images are reproduced in the Paper. These show the gradual changes which take place as sintering proceeds, in other words, the creation of a semi-molten phase interspersed between the still solid and higher melting-point quartz particles.

### Practical Interpretation

Conclusions from this work are drawn in the second article contributed by E. WAGNER, who points out that a determination of the melting point of a moulding sand is by no means as fundamental to and characteristic of its behaviour when coming in contact with molten metal, as is usually assumed. The investigations of v. Ardenne and Endell show, in fact, that the most refractory sand is not necessarily the most suitable for foundry use, but rather those sands which, in view of a critical content of fluxes, are able to cause a cementing of the sand particles when heated by the hot metal, such that the sand can be easily removed in subsequent fettling.

It is noted that the fillers of the best steelfoundry sands melt easily and quickly at 1,250 deg. to form a spherical globule of molten material; the same behaviour is shown by the bentonites, in particular the American Na bentonite. On the other hand, sands unsuitable for steelfoundry use are found to contain acicular masses at this temperature, adequate fusion taking place at about 1,400 deg. Hence, the lower the melting point of the sand fillers, the greater will be the degree of agglomeration of the moulding sand in question, which in turn will favour the incrustation of the sand on the surface of the casting and its subsequent ease of removal in fettling. Conversely, high melting point bonds will produce a rough surface on castings, many sand grains adhering firmly to the surface and being difficult to remove. The factors which appear to influence the final surface condition of the casting are:—(1) The state of the mould when pouring, whether dry or moist; (2) the final preparation of the surface of the mould; (3) the fineness grading in the moulding sand; (4) the percentage of bonders in the sand; (5) the chemical composition of the bonding materials; and (6) their viscosity at temperatures between 1,250 and 1,400 deg.

According to previous work on the suitability of sands, it has been assumed that incipient fusion, *i.e.*, sintering, of a good moulding sand should take place at a temperature below Seger cone 26, *i.e.*, about 1,600 deg. The work of v. Ardenne and Endell seems to indicate that the limiting temperature is, in fact, much lower; in the case of thin-walled steel castings, this critical temperature at which fusion of the bond should take place appears to be more in the region of 1,250 deg. No data are yet available of the critical temperature in the case of grey and malleable castings.

Wagner again emphasises that high refractoriness in a binder is certainly not a desideratum in foundry practice; it is far more important to have a high bonding strength and satisfactory plasticity. This would enable, he suggests, the use of many kaolin-type clays, which have been rejected in the past and which could now be made usable by adding plastic and flux-containing clays. The author also considers that it is fair to conclude from this work that the coal dust frequently added to moulding sands in grey-iron practice may through its ash be regarded as a fluxing medium. The work promises to throw further valuable light on the behaviour of moulding sands and their components at the casting temperature, and should be continued, concludes Wagner's commentary.

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## MOULD AND CORE DRYING

Under the auspices of the heat-economy committee of the Verein deutscher Giessereifachleute, W. CALLENBERG has compiled a monograph on the drying of cores and moulds. Published last winter by the Giessereiverlag, Düsseldorf, at the exorbitant price of 14 Rmk. to non-members, it has 146 pp., 128 illustrations and 20 tables. Judging from references in the German technical press to this monograph, it is essentially practical, with only a short section dealing theoretically with the principles of drying. A feature of the book appears to be the statement of the relative advantages and disadvantages of each drying technique, and a review of the considerations which should determine the choice of any particular technique, depending on the local conditions and whether the foundry is a small jobbing foundry or engaged on serial production. It appears that the greater number of drying equipments in German foundries are wasteful of heat, the author indicating how improvements in efficiency can be made, a vital problem in face of the present shortage of all kinds of fuel in Germany.

## CERTIFICATION OF AMERICAN DIE CASTERS

A certification plan in the die-casting industry, providing a method whereby metal used in special (high) quality zinc and aluminium die-castings of ammunition components—such as bomb and shell fuses—and other critical parts will be subjected to rigid inspection, came into force in the United States at the beginning of February. Spectrographic and X-ray eye inspection of special-quality zinc die-castings is required under the plan.

Any die-casting company which so desires may request certification directly of the Conservation Division of the War Production Board. With his request, the die-caster submits evidence of his ability to meet certification requirements. His plant will then be inspected by a competent committee which will determine the plant's ability to produce safe, high-quality zinc or aluminium die-castings. Because of the differences in the character of the two metals (more latitude in composition is permissible in the case of aluminium die-castings), zinc and aluminium will be certified separately. Any die-casting company which evidences willingness and ability to meet W.P.B. requirements will be certified to the armed services as a producer of special quality zinc and/or aluminium die-castings.

## U.S. MINERAL PRODUCTION IN 1943

W. A. Janssen, of the Metals and Minerals Section, Bureau of Foreign and Domestic Commerce, U.S. Department of Commerce, considers that in 1943, as in 1942, production in the non-ferrous metal and mineral industries in general will be limited only by production capacities. The domestic production of zinc, copper, tungsten, antimony, tin and beryllium, even at peak, will be insufficient to meet the requirements of the war programme. Imports of these commodities either in the form of ore, concentrates, or metal will have to continue without interruption. The value of all non-ferrous metal and mineral production in 1943 is expected to exceed the record achieved in 1942. Aluminium and magnesium production goals, established early in 1942, were not reached by the end of the year, but production will be materially increased during 1943. The 1943 mine production of lead, zinc, and mercury will probably equal but not appreciably exceed that of 1942. Further expansion is looked for in antimony, vanadium, tungsten, chromite, manganese and, possibly, molybdenum.

**Slag Control in Blast Furnaces**

Introduction of flux through blast-furnace tuyeres offers a solution to the problem of immediate control of iron analysis under conditions of widely fluctuating coke ash, points out C. G. HOGBERG in a recent Paper to the A.I.M.E. The adjustment of bosh slags to a lower thermal and a more uniform chemical range also offers possibilities of increased production and decreased coke rate inherent in operation with leaner bosh slags and utilisation of higher and more uniform blast temperatures.

## PERSONAL

MR. F. N. HEPWORTH has retired from the board of the Metal Box Company, Limited.

MR. WESLEY LAMBERT, C.B.E., informs us that his address is now 24, Caledon Road, Parkstone, Dorset.

DR. J. E. HURST is to represent the Institution of Mechanical Engineers on the Council of Ironfoundry Associations' Training Committee.

MR. ALLAN C. MACDIARMID, chairman of Stewarts and Lloyds, Limited, has been elected an extraordinary director of the Union Bank of Scotland.

MR. ROBERT C. GOOLD, works manager of Herbert Morris, Limited, of Loughborough, has been admitted as a Serving Brother of the Order of St. John.

LORD HAYTER OF CHISLEHURST, head of Chubb & Sons Lock & Safe Company, Limited, was 95 years of age on August 29. He has been associated with the firm since he was 17.

LORD DUDLEY G. GORDON has been elected a director of Hadfields, Limited, Sheffield. Lord Dudley Gordon is chairman of J. & E. Hall, Limited, and is a past-president of the Federation of British Industries and the British Engineers' Association.

MR. C. B. MITCALFE DALE has been appointed chief engineer of the Engine Division of the Brush Electrical Engineering Company, Limited, and subsidiaries, of Loughborough, on the resignation of Mr. H. V. Senior, who becomes consultant to the company.

MR. W. H. MARSDEN has been appointed a director of Cornercroft, Limited, iron and non-ferrous founders, motor and aircraft equipment manufacturers, etc., of Coventry. He has been secretary and chief accountant to the company since its formation as a public concern in 1936, and he will continue to hold those offices.

MR. J. H. D. BRADSHAW was recently presented with a silver tea set and a wallet of notes by the directors and staff of Bradley & Foster, Limited, Darlaston Ironworks, Darlaston, Staffs, on the occasion of his leaving the employment of the company. Mr. Bradshaw has been with the company for the last 15 years.

MR. W. GEARY, melting shop superintendent at the Cleveland Iron and Steel Works, who has been 30 years in the service of Dorman, Long & Company, Limited, has been appointed assistant works manager of the Appleby-Frodingham plant at Scunthorpe, and leaves Tees-side to take up his new post at the end of September. He is vice-chairman of the Open Hearth Committee of the British Iron & Steel Federation.

MR. JOHN A. HOPKINSON, a director of Jonas & Colver (Novo), Limited, Sheffield, has been appointed Regional Controller, Ministry of Production, for the East and West Ridings Region and chairman of the East and West Ridings Regional Board. Mr. Hopkinson succeeds Mr. Charles H. Crabtree. He was formerly in charge of a production department of Hadfields, Limited, Sheffield. Later he was for several years technical and sales representative in the United States and Canada for Sheffield firms.

## CHANGES IN PRODUCTION PROGRAMMES

In a statement made in London last week, on changes in the production programmes, the Minister of Production, Mr. Oliver Lyttelton, said that the rearrangements he announced last January had brought the desired results. His Ministry planned still further increase in our total war production and particularly in our aircraft programme. In total, more people would be employed. On the other hand, the continued switch from Army to aircraft production made it almost inevitable that there would from time to time be small numbers of workers unemployed or not fully occupied for short periods. Such a situation, at a time of extreme labour stringency, was extremely difficult for those affected to understand, and for this reason he asked for the co-operation and help of all concerned in industry. The numbers who would be thus affected were insignificant in relation to the total numbers employed in the munitions industries, and he was hopeful that the policy which they had laid down for dealing with those changes would ensure that the numbers affected were limited to the practicable minimum.

The combined output of the United Nations was now three times that of the Axis, and would be four times that of the Axis in 1944. We needed this vast superiority of armaments if we were to carry our offensive to a successful conclusion. But this superiority would in itself mean little, unless the weapons and equipment we were producing were of the first quality and of the right types. It was to retain our superiority in quality as well as in quantity that these production changes were essential.

## NEWS IN BRIEF

MR. C. B. HARRIS, 3, Staple Inn, London, W.C., has been appointed liquidator (with a committee of inspection) of Metal Abrasives, Limited, 79, Pentonville Road, London, N.1.

MR. CHARLES JOHN RICE, 137, Mayplace Road, Bexleyheath, Kent, trading at 94, Mayplace Road, Bexleyheath, iron and metal merchant, is paying a supplemental dividend of 1s. in the £.

THE SCRAP IRON SHORTAGE at foundries in Eire is becoming acute, and it is expected that the Government will shortly insist on the sacrifice of all iron gates and railings throughout the country.

AN EXTRAORDINARY meeting of James Booth & Company (1915), Limited, will be held at Birmingham on September 22, to consider a special resolution that the name of the company be changed to James Booth & Company, Limited.

A MEETING of the Institute of Welding will be held at the Conway Hall, Red Lion Square, Holborn, London, W.C.1, on Thursday, September 16, at 5.30 p.m., when Mr. G. F. Clipsham, B.Sc., Tech., will present a Paper on "Classification of Arc Welding Electrodes."

## OBITUARY

MR. ALEXANDER CLAPPERTON, a director of the Shotts Iron Company, Limited, has died, aged 62.

MR. GEORGE THOMAS BELL, of South Shields, joint general manager of White's Marine Engineering Company, Limited, Hebburn, died recently.

MR. CHARLES STEWART PICKERING ROBSON, a director of Hick, Hargreaves & Company, Limited, Soho Iron Works, Bolton, died recently.

MR. JULIUS LEONARD FOX VOGEL, of Widnes, general manager of High Speed Steel Alloys, Limited, died at Sandy, Bedfordshire, on August 30, aged 70.

MR. JOHN ROBERTSHAW BAINES, for 16 years commercial manager of the Central Marine Engine Works (W. Gray & Company, Limited), West Hartlepool, died recently.

CAPT. WALTER EDMUND EVANS, R.A.S.C., son of Mr. E. W. Evans, Cardiff, and a partner in the firm of Mactaggart & Evans, analytical and metallurgical chemists, died in August as a result of a climbing accident in Syria.

PROFESSOR JOHN HILTON, well known for his broadcast talks, died at Cambridge recently. He had occupied the Montague Burton Chair of Industrial Relations at Cambridge from 1931. In 1919, he was appointed assistant secretary and Director of Statistics at the Ministry of Labour, in which position he produced the official "Labour Gazette" and travelled widely studying wages, cost of living, unemployment, and kindred subjects.

MR. ROBERT GUTHRIE WOODWARD, a director of Edgar Allen & Company, Limited, Imperial Steel Works, Tinsley, Sheffield, died recently, aged 62. He joined the firm in 1898, and had practical experience in all the departments, including the commercial side of the business. He also studied metallurgy and electricity, and travelled as a representative of the firm for two years in the Eastern and Midland Counties. Mr. Woodward spent nine months in South Africa and Rhodesia in 1907, and later he was responsible for organising the firm's purchasing and publicity departments. He became a member of the Iron & Steel Institute in 1904.

MR. RICHARD BORLASE MATTHEWS, who died recently, as the result of a bathing accident, was an electrical engineer known for his work on the use of electricity in farming. After serving his apprenticeship in the United Kingdom he went to America, where he became a departmental engineer with the General Electric Company at Schenectady and chief electrical engineer to the Edison Electric Light & Power Company at Amsterdam. Returning to England he began practice as a consulting engineer in 1906. Taking up aeronautical work in 1908, he claimed to be the first aeronautical consulting engineer, and during the last war he was on the technical staff of the Air Ministry. Afterwards he carried out extensive experiments on the application of electricity to agriculture.

# STANTON DALE

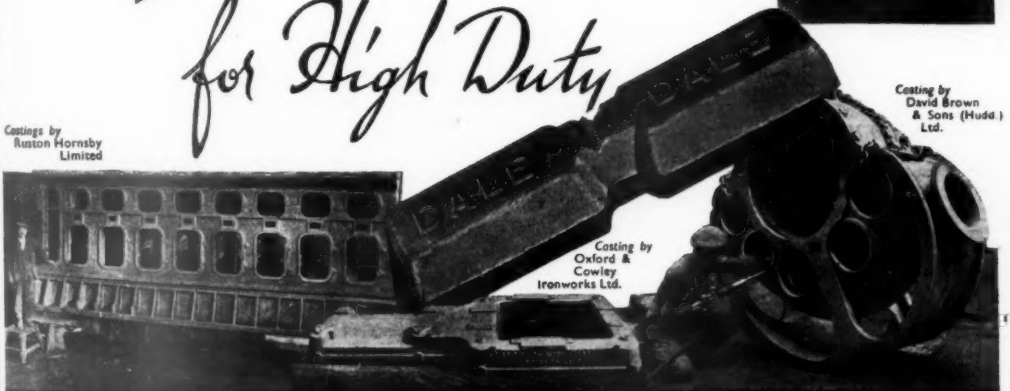
## Refined PIG IRON

## for High Duty

Castings by Morris Motors Limited.

Casting by Baker Perkins Limited

Castings by Ruston Hornsby Limited



Castings by Ruston Hornsby Limited

Casting by David Brown & Sons (Hudd.) Ltd.

Casting by Oxford & Cowley Ironworks Ltd.

THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

## COMPANY RESULTS

*(Figures for previous year in brackets)*

**Quirk Barton**—Interim dividend of 2½% (same).

**Bestwood Coal & Iron**—Dividend of 5% (6%).

**Oxley Engineering**—Dividend of 15% (12½%).

**W. Canning & Company**—Interim dividend of 5% (same).

**A. & J. Main & Company**—Ordinary dividend of 10% (same).

**Bairds & Scottish Steel**—Dividend on the preference shares of 3% in respect of the half-year ended June 30, 1943.

**Staveley Coal & Iron**—Final dividend on the ordinary stock of 4%, free of tax, making 6½%, free of tax (same).

**Sheepbridge Coal & Iron**—Final dividend for the year ended June 30, 1943, of 5%, free of tax, on the ordinary shares, making 8%, tax free (same).

**Hallamshire Steel & File**—Profit to March 31, £40,610; tax, £17,768; war damage insurance, £864; contingency reserve, £7,500; final dividend of 1s. 9d., tax free, making 2s. 6d. (2s.), tax free; forward, £10,195.

**Tata Iron & Steel**—Net profit to March 31 last, after tax and depreciation, Rs. 2,72,23,525 (Rs. 3,67,56,083); to reserve, Rs. 35,00,000 (Rs. 1,00,00,000); ordinary dividend of Rs. 23 (Rs. 15); deferred dividend, Rs. 129-8-9 (Rs. 72-4-4); forward, Rs. 9,43,102 (Rs. 11,63,751).

**Bennis Combustion**—Net profit for the year to April 30, 1943, £25,570 (£29,034); taxation, £10,500 (£13,750); to staff fund, £1,000 (same); ordinary dividend of 10% (same); to general reserve, £1,000 (£4,000); provision for balance of 1943-44 income-tax, £7,500 (£3,000); forward, £2,368 (£3,578).

**Davy & United Engineering**—Profit for the year ended March 31, £90,298; taxation, £44,553; net profit, £45,745 (£48,532); dividend of 7½% (same), £23,531; to reduction of the value of the consideration for trading and manufacturing agreement with United Engineering & Foundry Company, £5,000 (same); forward, £156,475 (£139,261).

**Sheffield Steel Products**—Profit for the year to March 31, after fees and debenture interest and sinking fund, £80,025 (£48,971); depreciation, £25,000 (£25,600); deferred repairs, £20,000 (nil); A.R.P., nil (£1,013); dividend of 7½% (5%); additional debenture sinking fund, £3,489 (£2,326); to general reserve, £20,000 (£10,000); forward, £22,123 (£17,565).

**Butterley Company**—Trading profit for the year to March 31, after £78,758 (£78,393) for depreciation, £392,307 (£251,629); taxation reserve, £200,000 (£116,000); A.R.P. expenditure, £11,584 (£14,831); war damage contributions, £8,620 (£593); deferred repairs, £13,500 (nil); preference dividend, £21,250 (same); net profit, £144,783 (£102,848); to reserve, £35,000 (£10,000); ordinary dividend of 12% (10%); forward, £65,042 (£63,259).

## MANUFACTURE OF STEELWORKS PLANT

In a statement to the shareholders of Davy & United Engineering Company, Limited, which accompanies the annual report and accounts, Mr. E. J. Fox (chairman) refers to the steps which are being taken to co-operate with the iron and steel industry "in order to ensure a progressive policy of technical development in the joint interests of the engineering industry and of the iron and steel industry." It is in the national interest, he says, that together with other engineering concerns covering the whole field of iron and steel works plant manufacture they should co-operate with the users of their products in establishing an adequate and efficient service in this country, thereby eliminating the dependence or partial dependence of the iron and steel industry on foreign designers and manufacturers.

Lack of opportunity in the past has restricted the development of their particular branch of the British engineering industry, but from the advantages to be derived from the arrangements now being made the industry will be able to attain a technical standard no less advanced than that in other countries, thereby extending its activities not only at home but abroad. Questions have been asked recently as to whether the co-operation now taking place amounts to a control by one or more of the iron and steel companies of the engineering companies participating in the co-operation. There is no question of control by any company, says Mr. Fox. It is well understood by those taking part in the scheme of co-operation that the efficiency and independence of the engineering industry and the ability of its individual members to provide the best service to the iron and steel companies are the first requirements necessary to attain the objects aimed at. In these circumstances no favours or preferential treatment will arise between the participating parties, and success will be achieved only by efficiency and good service.

## NEW COMPANIES

*("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)*

**Wilsons Hilmon Foundries,** 45, Pool Street, Wolverhampton—£100. L. Davis and J. E. Wilson.

**John Lloyd & Sons (Engineers),** 12, Frederick Street, Birmingham—£8,000. A. J. and A. E. Lloyd.

**A.B.S. (Engineering),** Queen Street, Gomshall, Dorking, Surrey—£1,000. A. C. Abbott, F. G. Slyfield and A. N. Budgin.

**Herbert Ellis (Engineers),** 106A, Derby Road, Bootle—£3,000. T. H. Simpson, H. Ellis, W. Brown and W. G. Chambers.

BRISTOL ENGINEERING MANUFACTURERS' ASSOCIATION, 104, Filton Avenue, Bristol, 7, would be glad to receive copies of publications issued by firms and organisations.

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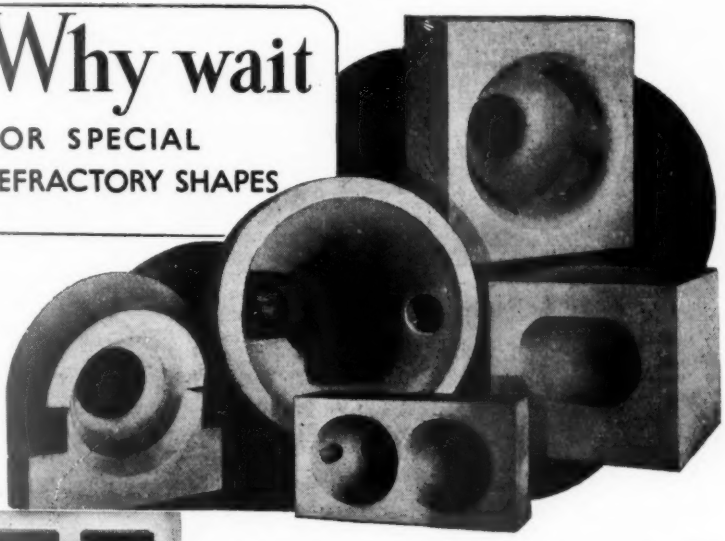

**NO SHRINKAGE.** Illustration (1) shows two blocks cast in moulds and dried at atmospherictemperature. One was fired to 1500° C for four hours. Specimens are the same size.

**STRENGTH.** Illustration (2) shows two test pieces cast in moulds, dried at atmospheric temperature and one heated to 1000° C. Tensile strength —*Unfired*, 550 lbs. per sq. in. *Fired*, 1312 lbs. per sq. in.

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33

## Raw Material Markets

### IRON AND STEEL

Although it is true to say that there is sufficient pig-iron available to satisfy all the needs of foundrymen and steelmakers, many consumers are not getting the grade to which they are accustomed. This applies particularly to the heavy engineering and allied foundries; their normal requirements are of the better-class irons, such as low-phosphorus iron and hematite, supplies of which are now short, and what is on hand is kept for the use of priority users who are unable to utilise any other grade. In view of the favourable progress of the Allied war machine it might have been expected that by now there would have been larger shipments of North African iron ore to this country, as it is ore such as is found in that sphere that is used in the manufacture of the better qualities of iron. These shipments could doubtless be made if the need became really vital, but there are even more important uses for cargo space at the present time, so that the authorities are not inclined to resume larger shipments of ore for the time being.

There is little change in the position of iron-foundries from week to week. Makers of heavy castings have more than enough work at their command, whereas the light-foundry trade is open to receive much larger orders than are offered them at present. Only those light foundries who have been able to adapt plant to the manufacture of heavier castings than they normally produce are anything like busy.

There is no difficulty in securing adequate supplies of foundry coke. Production is plentiful in most districts, and day-to-day deliveries are well up to schedule. Many foundries have acquired stocks during the past few months to be used in the winter, when supplies are sometimes more difficult to obtain. Users of furnace coke can also obtain supplies sufficient for their needs without any difficulty.

There has been no relaxation of the pressure for steel plates. Pre-fabricators are being supplied with American plates, and some of the sheet mills have also been diverted to the rolling of steel plates of ¼ in. and upwards. Nevertheless, the mills seem to make no impression on the accumulation of orders, and it would be difficult, if not impossible, to obtain execution of further orders this year. Bookings for heavy sections leave scope for improvement, but there is a big demand for light sections and bars. Collieries and railways have increased their requisitions for maintenance material, and the exceptional activity in all branches of the engineering trades provides strong support. British steelmakers have made a good response to the call for increased tonnages of steel semis in the form of billets, blooms, and sheet bars, and the use of imported material has been substantially reduced, notwithstanding the accelerated activities of the re-rolling mills. Very largely increased tonnages of re-rolled material are called for during the closing months of the year, and it would appear that fulfilment of these heavy commitments is not likely to be impeded by any shortage of material, although re-rollers are still obliged to use a considerable proportion of defective billets, etc.

### NON-FERROUS METALS

Important users of copper are not going short of supplies, and it is confidently anticipated that sufficient metal will continue to be forthcoming to satisfy urgent needs. The fact that ordinary domestic users are not receiving their normal supplies does not indicate any real shortage, but is due to the desire of the authorities to keep imports down to the lowest level compatible with the requirements of the war effort.

Consumption of tin in tinplate in the United States is expected to be reduced by a further 6,000 tons per annum. The War Production Board has issued a new regulation making the use of electrolytic tinplate for certain descriptions of cans mandatory. It is anticipated that, when this regulation is fully effective, consumption of tin in the manufacture of tinplate will fall to around only 18,000 tons a year. According to estimates of the American Bureau of Metal Statistics, consumption of tin in tinplate in the United States in 1942 was 31,619 short tons, against 53,951 tons in 1941, the percentage of tin in the finished tinplate being 1.271 per cent., compared with 1.622 per cent. in the previous year. In terneplate only 996 tons of tin, or 0.316 per cent. of the total weight of the product, were consumed, compared with 2,436 tons, or 0.503 per cent. in 1941. Total consumption in tin and terneplates, amounting to 32,916 short tons, was somewhat lower than expected.

Cable and battery makers are well to the fore in the demand for lead, and these trades are taking up large quantities for urgent war purposes. While there has been a big expansion in consumption of lead in these industries, there has been a bigger decline in the demand from the building trade, which, in normal times, is the chief working-up industry.

### NEW TRADE MARKS

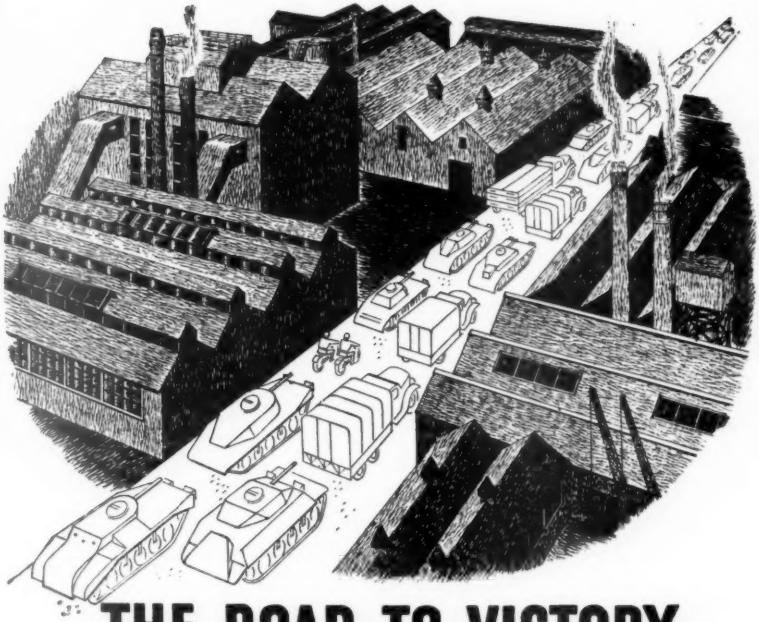
*The following applications to register trade marks appear in the "Trade Marks Journal":—*

"PERMANOID"—Insulated electric wire and electrical insulating sleevings. ASSOCIATED TECHNICAL MANUFACTURERS, LIMITED, Vincent Works, St. Vincent Street, New Islington, Manchester, 4.

"SECOMAK"—Machine tools, pumping machinery, electrically driven pumps, electric motors and dynamos. SERVICE ELECTRIC COMPANY, LIMITED, Abbey Estate, Mount Pleasant, Alperton, Middx.

"AGATINE" and "AGATOR"—Sieves (machines), screening machines, belts for conveying, elevating and power transmission. N. GREENING & SONS, LIMITED, Britannia Works, Bewsey Road, Warrington.

"PLIMANITE"—Furnace lining material of the nature of cement for preventing the radiation of heat. JOINTLESS FIREBRICK COMPANY, LIMITED, Plibrico Works, Westmorland Road, The Hyde, London, N.W.9.



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# CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

*(Delivered, unless otherwise stated)*

**Wednesday, September 8, 1943**

## PIG-IRON

**Foundry Iron.**—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

**Hematite.**—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

**Low-phosphorus Iron.**—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

**Scotch Iron.**—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

**Cylinder and Refined Irons.**—North Zone, 174s.; South Zone, 176s. 6d.

**Refined Malleable.**—North Zone, 184s.; South Zone, 186s. 6d.

**Cold Blast.**—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

## FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

**Ferro-silicon** (5-ton) lots.—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43.

**Ferro-vanadium.**—35/50 per cent., 15s. 6d. per lb. of V.

**Ferro-molybdenum.**—70/75 per cent., carbon-free, 6s. per lb. of Mo.

**Ferro-titanium.**—20/25 per cent., carbon-free, 1s. 3½d. lb.

**Ferro-tungsten.**—80/85 per cent., 9s. 8d. lb.

**Tungsten Metal Powder.**—98/99 per cent., 9s. 9½d. lb.

**Ferro-chrome.**—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

**Cobalt.**—98/99 per cent., 8s. 9d. lb.

**Metallic Chromium.**—96/98 per cent., 4s. 5d. lb.

**Ferro-manganese.**—78/98 per cent., £18 10s.

**Metallic Manganese.**—94/96 per cent., carb.-free, 1s. 9d. lb.

## SEMI-FINISHED STEEL

**Re-rolling Billets, Blooms and Slabs.**—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

**Billets, Blooms and Slabs for Forging and Stamping.**—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s. 6d.; acid, up to 0.25 per cent. C, £16 5s.

**Sheet and Tinplate Bars.**—£12 2s. 6d., 6-ton lots.

## FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

**Plates and Sections.**—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

**Bars, Sheets, etc.**—Rounds and squares, 3 in. to 5¼ in., £16 18s.; rounds, under 3 in. to ⅝ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

**Tinplates.**—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

## NON-FERROUS METALS

**Copper.**—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

**Tin.**—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

**Spelter.**—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

**Lead.**—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

**Zinc Sheets, etc.**—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

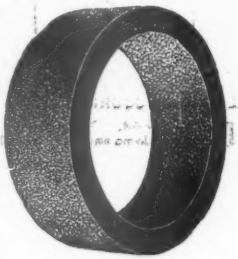
**Other Metals.**—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

**Brass.**—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10¾d.; wire, 10¾d.; rolled metal, 10¼d.; yellow metal rods, 9d.

**Copper Tubes, etc.**—Solid-drawn tubes, 15¼d. per lb.; brazed tubes, 15¼d.; wire, 10d.

**Phosphor Bronze.**—Strip, 13¾d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21¼d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

**Nickel Silver, etc.**—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 15 in. wide, 1s. 4¼d. to 1s. 10¼d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5¼d. to 1s. 11¼d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6¼d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9¼d. Wire round, to 10g., 1s. 7¼d. to 2s. 2¼d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6¼d. upwards.



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# FOUNDRY TRADE JOURNAL

EST. 1902

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SEPTEMBER 9, 1943

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